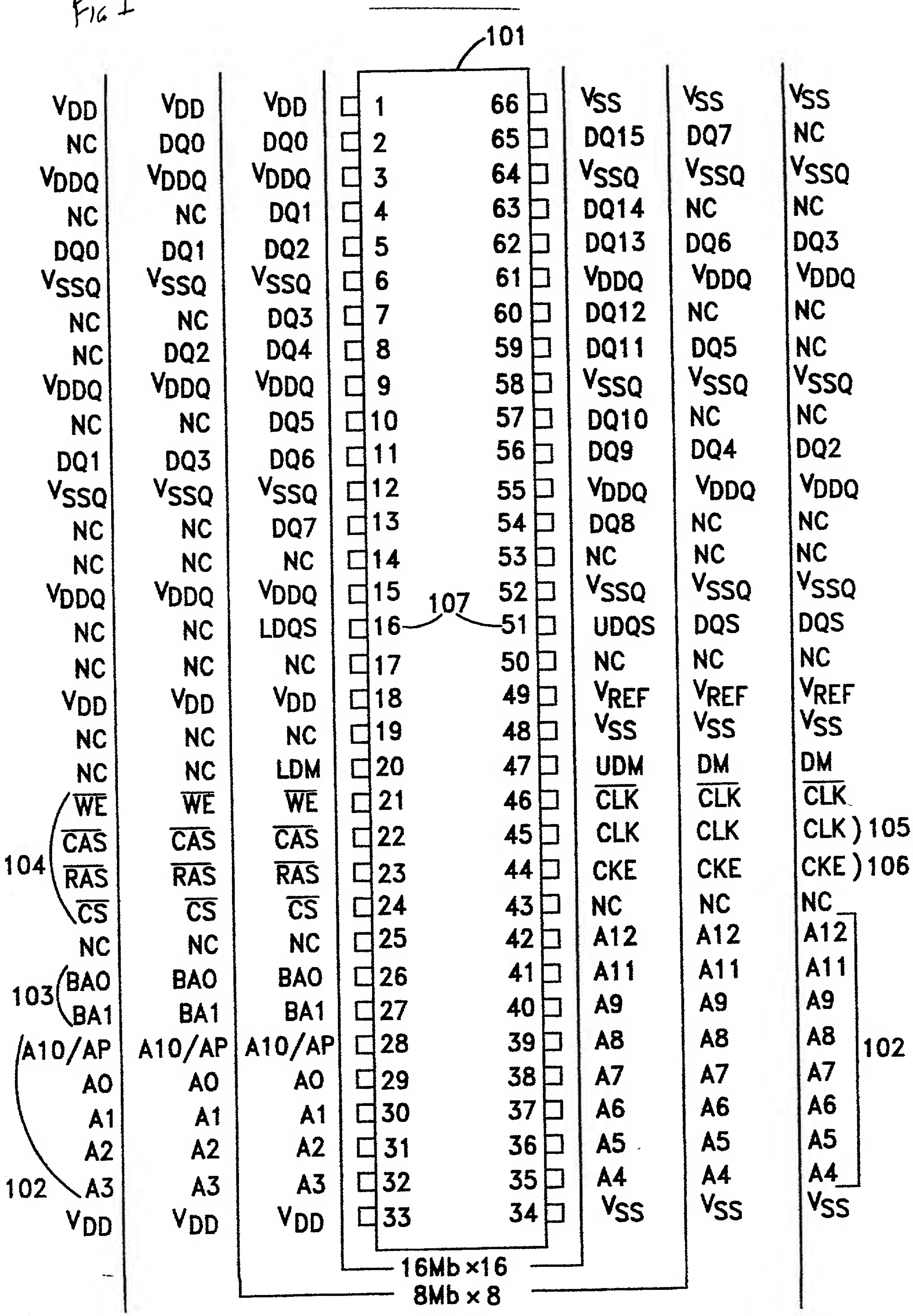
FIG 1


101
VDD VDD VDD 1 66 VSS VSS VSS
NC DQ0 DQ0 2 65 DQ15 DQ7 NC
VDDQ VDDQ VDDQ 3 64 VSSQ VSSQ VSSQ
NC NC DQ1 4 63 DQ14 NC NC
DQ0 DQ1 DQ2 5 62 DQ13 DQ6 DQ3
VSSQ VSSQ VSSQ 6 61 VDDQ VDDQ VDDQ
NC NC DQ3 7 60 DQ12 NC NC
NC DQ2 DQ4 8 59 DQ11 DQ5 NC
VDDQ VDDQ VDDQ 9 58 VSSQ VSSQ VSSQ
NC NC DQ5 10 57 DQ10 NC NC
DQ1 DQ3 DQ6 11 56 DQ9 DQ4 DQ2
VSSQ VSSQ VSSQ 12 55 VDDQ VDDQ VDDQ
NC NC DQ7 13 54 DQ8 NC NC
NC NC NC 14 53 NC NC NC
VDDQ VDDQ VDDQ 15 52 VSSQ VSSQ VSSQ
NC NC LDQS 16 107 51 UDQS DQS DQS
NC NC NC 17 50 NC NC NC
VDD VDD VDD 18 49 VREF VREF VREF
NC NC NC 19 48 VSS VSS VSS
NC NC LDM 20 47 UDM DM DM
WE WE WE 21 46 CLK CLK CLK
104 CAS CAS CAS 22 45 CLK CLK CLK 105
RAS RAS RAS 23 44 CKE CKE CKE 106
CS CS CS 24 43 NC NC NC
NC NC NC 25 42 A12 A12 A12
103 BA0 BA0 BA0 26 41 A11 A11 A11
BA1 BA1 BA1 27 40 A9 A9 A9
A10/AP A10/AP A10/AP 28 39 A8 A8 A8 102
A0 A0 A0 29 38 A7 A7 A7
A1 A1 A1 30 37 A6 A6 A6
A2 A2 A2 31 36 A5 A5 A5
102 A3 A3 A3 32 35 A4 A4 A4
VDD VDD VDD 33 34 VSS VSS VSS
16Mb ×16
8Mb × 8

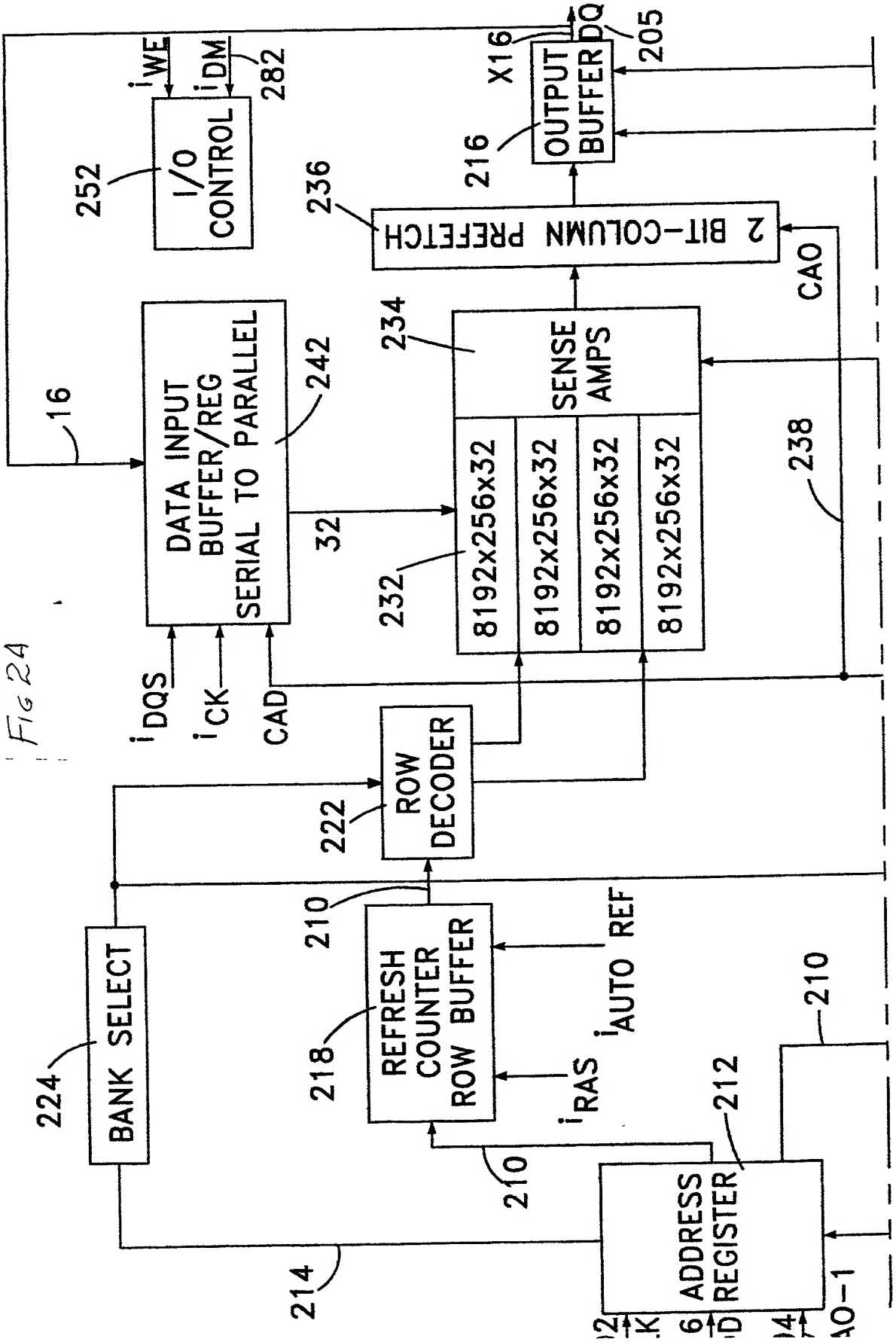

i WE
i DM
282
252
I/O CONTROL
X16
DQ
205
OUTPUT BUFFER
216
236
2 BIT-COLUMN PREFETCH
CA0
234
SENSE AMPS
16
DATA INPUT BUFFER/REG SERIAL TO PARALLEL
242
8192x256x32
8192x256x32
8192x256x32
8192x256x32
232
32
238
i DQS
i CK
CAD
ROW DECODER
222
210
REFRESH COUNTER ROW BUFFER
218
i AUTO REF
i RAS
BANK SELECT
224
214
ADDRESS REGISTER
212
210
210
6
14
0-1

Fig 24

FIG 2B

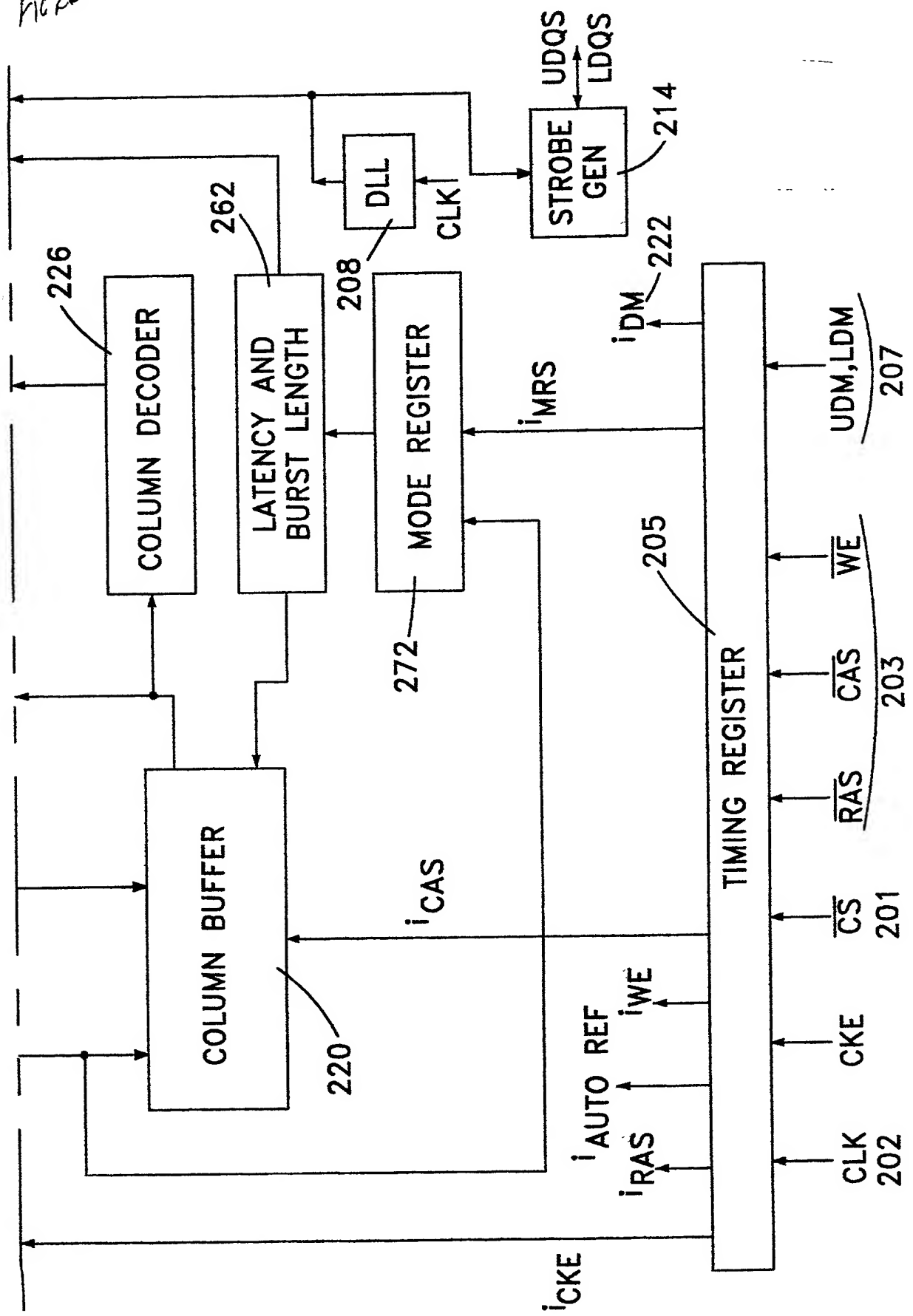

UDQS
LDQS
214
STROBE GEN
DLL
CLK
208
262
226
COLUMN DECODER
LATENCY AND BURST LENGTH
MODE REGISTER
272
222
iDM
iMRS
UDM,LDM
207
205
TIMING REGISTER
WE
CAS
RAS
203
CS
201
CKE
CLK
202
COLUMN BUFFER
220
iCAS
iWE
iAUTO REF
iRAS
iCKE

FIG 3

OPERATION	CKE n-1	CKE n	$\overline{CS}$	$\overline{RAS}$	$\overline{CAS}$	$\overline{WE}$	DM	BA_0 BA_1	A_{10}	A_0 A_9 A_{11}	MNE	NOTES
DEVICE DESELECT	H	X	H	X	X	X	X	X	X	X	INHBT	
NO OPERATION	H	X	L	H	H	H	X	X	X	X	NOP	
LOAD MODE REGISTER MODE OR EXTENDED MODE REGISTER	H	X	L	L	L	L	X	OP CODE			MRS/EMRS	1
ROW ACTIVATE	H	X	L	L	H	H	X	BS	ROW ADDRESS		ACT	2
READ	H	X	L	H	L	H	X	BS	L	COL	RD	3
READ W/ AUTO PRECHARGE	H	X	L	H	L	H	X	BS	H	COL	RAP	3
WRITE	H	X	L	H	L	L	V	BS	L	COL	WR	3,4
WRITE W/ AUTO PRECHARGE	H	X	L	H	L	L	V	BS	H	COL	WAP	3,4
BURST STOP	H	X	L	H	H	L	X	X	X	X	BST	5
PRECHARGE SINGLE BANK	H	X	L	L	H	L	X	BS	L	X	PRE	
PRECHARGE ALLBANKS	H	X	L	L	H	L	X	X	H	X	PREALL	
AUTO REFRESH	H	H	L	L	L	H	X	X	X	X	REF	1
SELF REFRESH ENTRY	H	L	L	L	L	H	X	X	X	X	SR(ENTRY)	1
SELF REFRESH EXIT	L	H	H	X	X	X	X	X	X	X	SR(EXIT)	
	L	H	L	H	H	H	X	X	X	X		
POWER DOWN MODE (ENTRY)	H	L	H	X	X	X	X	X	X	X	PDN(ENTRY)	
	H	L	L	H	H	H	X	X	X	X		
POWER DOWN MODE (EXIT)	L	H	X	X	X	X	X	X	X	X	PDN(EXIT)	

1 SHOULD BE ISSUED ONLY AFTER BOTH BANKS ARE DEACTIVATED (PREALL COMMAND)
2 SHOULD BE ISSUED ONLY AFTER THE CORRESPONDING BANK HAS BEEN DEACTIVATED
3 SHOULD BE ISSUED AFTER THE CORRESPONDING BANK HAS BEEN ACTIVATED
4 ANY VALUED WRITE CYCLE APPLIED TO THE SLECTED BANK/ROW WILL BE MASKED ACCORDING TO THE DM 5 SHOULD BE ISSUED ONLY DURING READ BURST CYCLE

Fig 4A

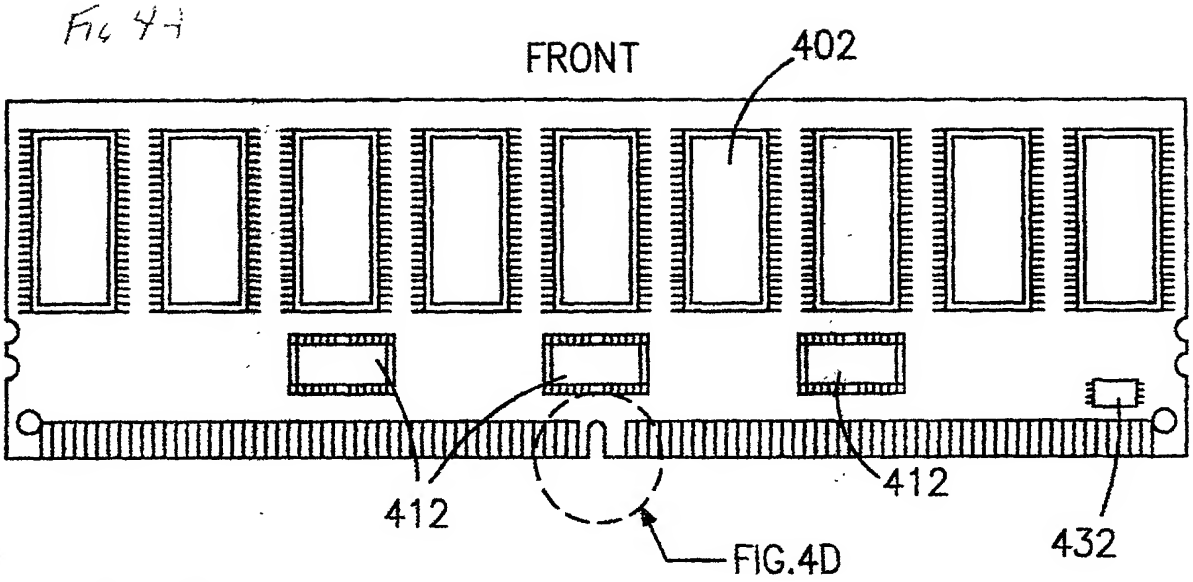
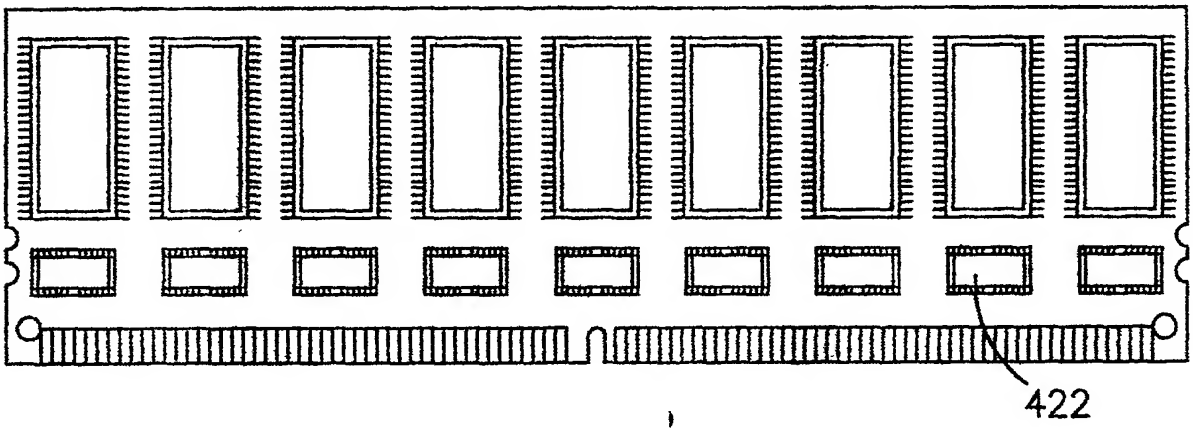


Fig 4B



SIDE

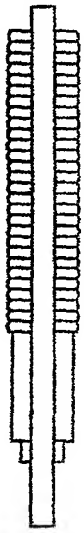


Fig 4C

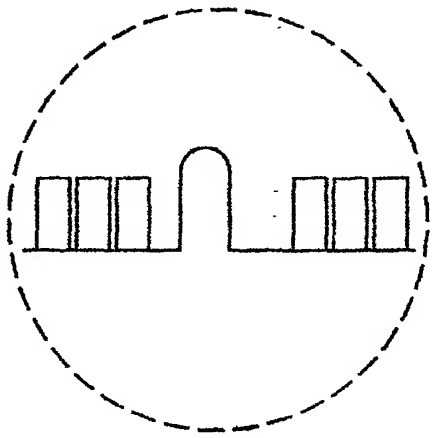


Fig 4D

FIG 5A

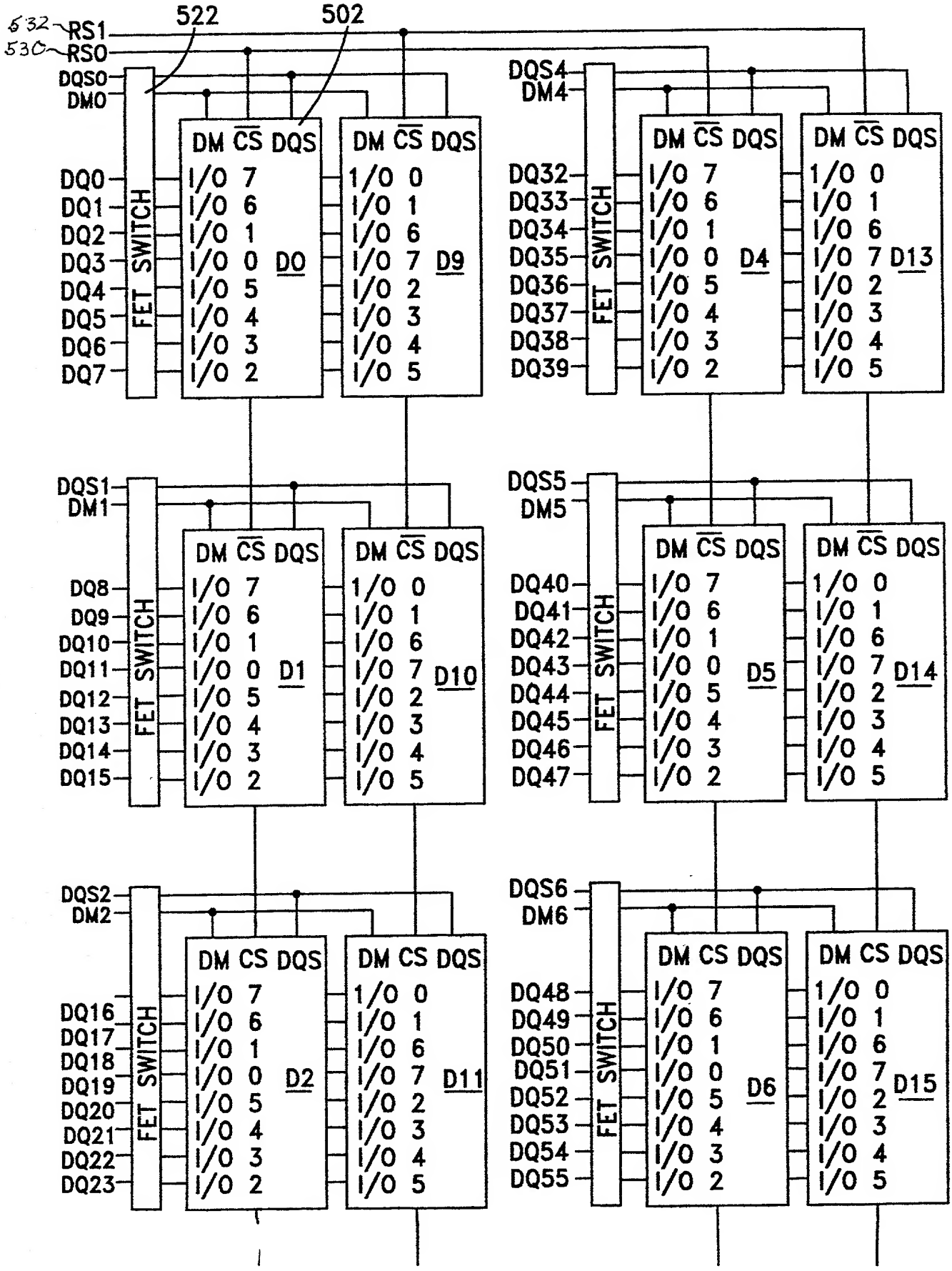
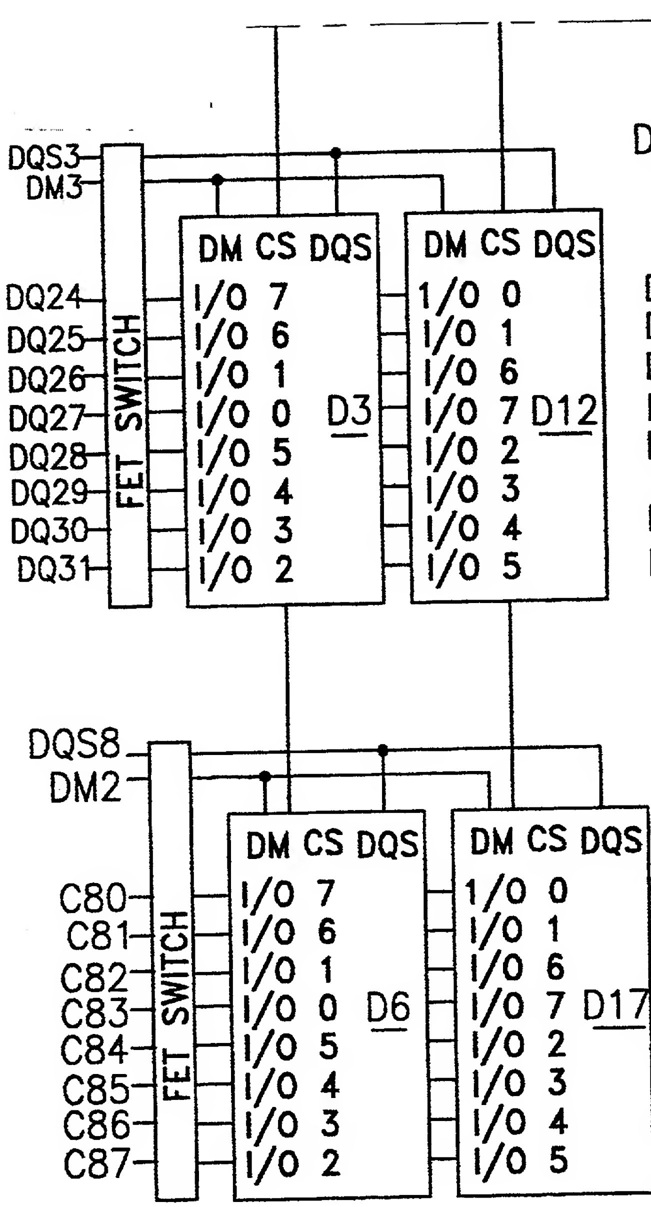

522
502
632
RS1
530
RS0
DQS0
DM0
DQS1
DM1
DQS2
DM2
DQS4
DM4
DQS5
DM5
DQS6
DM6
FET SWITCH
DM CS DQS
I/O 7
I/O 6
I/O 1
I/O 0
I/O 5
I/O 4
I/O 3
I/O 2
1/O 0
I/O 1
I/O 6
I/O 7
I/O 2
I/O 3
I/O 4
I/O 5
DQ0
DQ1
DQ2
DQ3
DQ4
DQ5
DQ6
DQ7
D0
D9
DQ8
DQ9
DQ10
DQ11
DQ12
DQ13
DQ14
DQ15
D1
D10
DQ16
DQ17
DQ18
DQ19
DQ20
DQ21
DQ22
DQ23
D2
D11
DQ32
DQ33
DQ34
DQ35
DQ36
DQ37
DQ38
DQ39
D4
D13
DQ40
DQ41
DQ42
DQ43
DQ44
DQ45
DQ46
DQ47
D5
D14
DQ48
DQ49
DQ50
DQ51
DQ52
DQ53
DQ54
DQ55
D6
D15

Fig 5B


DQS3
DM3
DQ24
DQ25
DQ26
DQ27
DQ28
DQ29
DQ30
DQ31
FET SWITCH
DM CS DQS
I/O 7
I/O 6
I/O 1
I/O 0
I/O 5
I/O 4
I/O 3
I/O 2
D3
DM CS DQS
I/O 0
I/O 1
I/O 6
I/O 7
I/O 2
I/O 3
I/O 4
I/O 5
D12
DQS7
DM7
DQ56
DQ57
DQ58
DQ59
DQ60
DQ61
DQ62
DQ63
FET SWITCH
DM CS DQS
I/O 7
I/O 6
I/O 1
I/O 0
I/O 5
I/O 4
I/O 3
I/O 2
D7
DM CS DQS
I/O 0
I/O 1
I/O 6
I/O 7
I/O 2
I/O 3
I/O 4
I/O 5
D16
DQS8
DM2
C80
C81
C82
C83
C84
C85
C86
C87
FET SWITCH
DM CS DQS
I/O 7
I/O 6
I/O 1
I/O 0
I/O 5
I/O 4
I/O 3
I/O 2
D6
DM CS DQS
I/O 0
I/O 1
I/O 6
I/O 7
I/O 2
I/O 3
I/O 4
I/O 5
D17

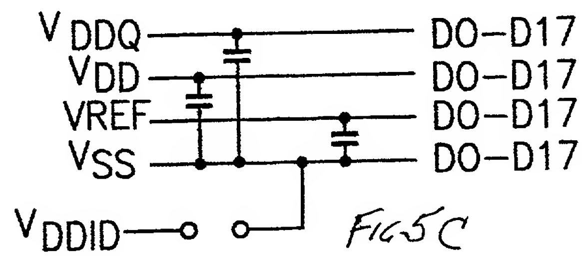


Fig 5C

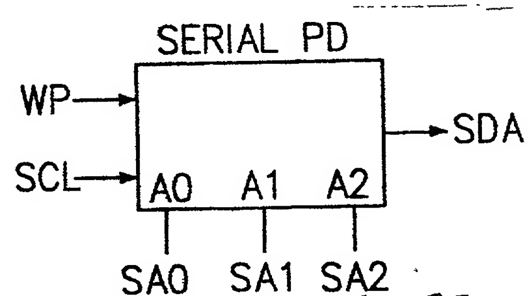


FIG 5E

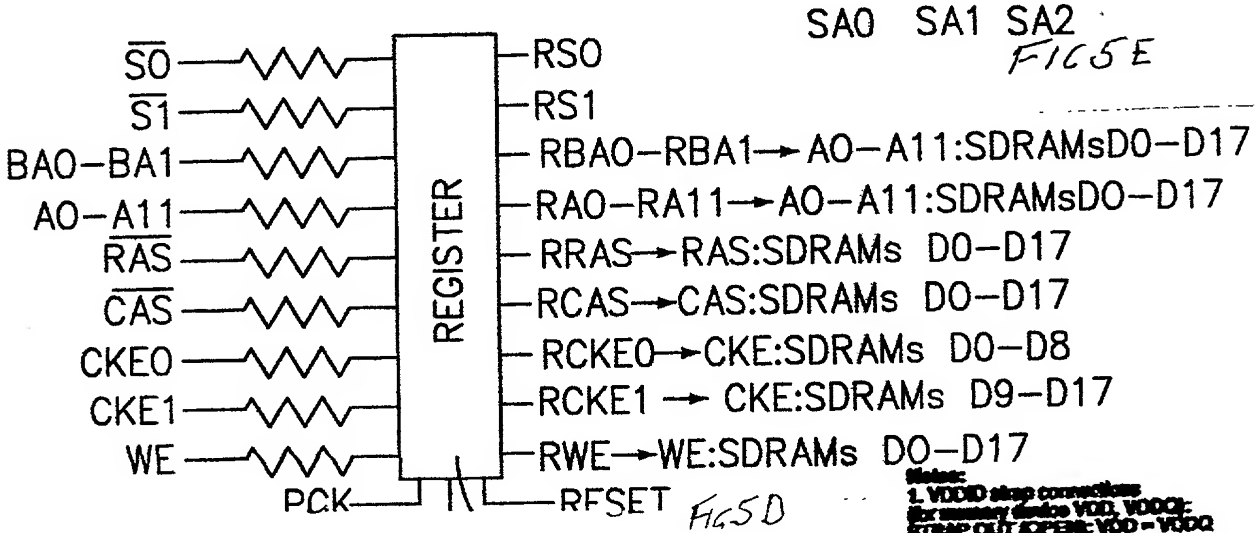


Fig 5D

Notes:
1. VDDID strap connections (for memory device VDD, VDDQ):
STRAP OUT (OPEN): VDD = VDDQ
STRAP IN (VSS): VDD ≠ VDDQ
2. See FET switch detail for more information

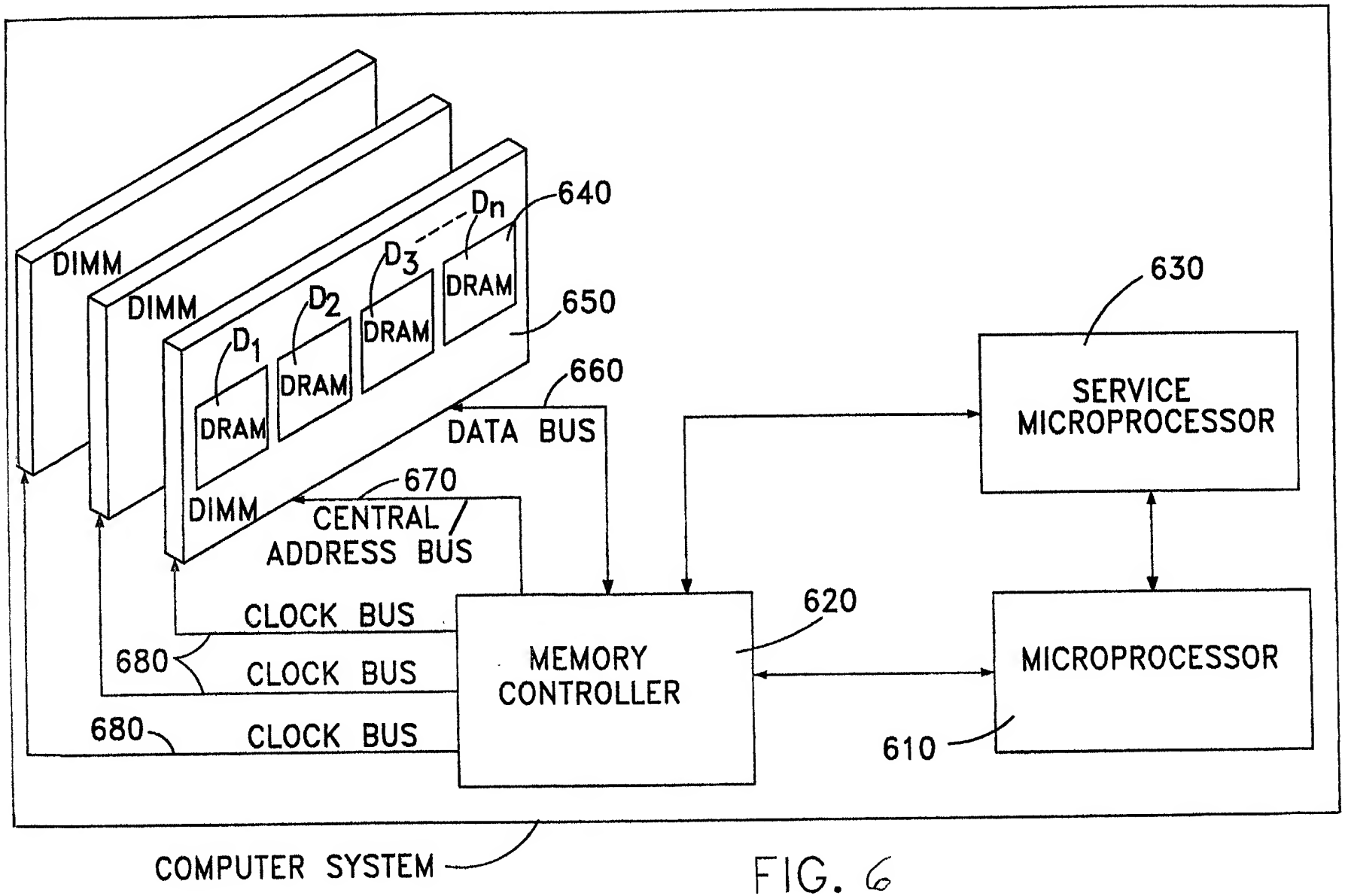


FIG. 6

FIG 7A

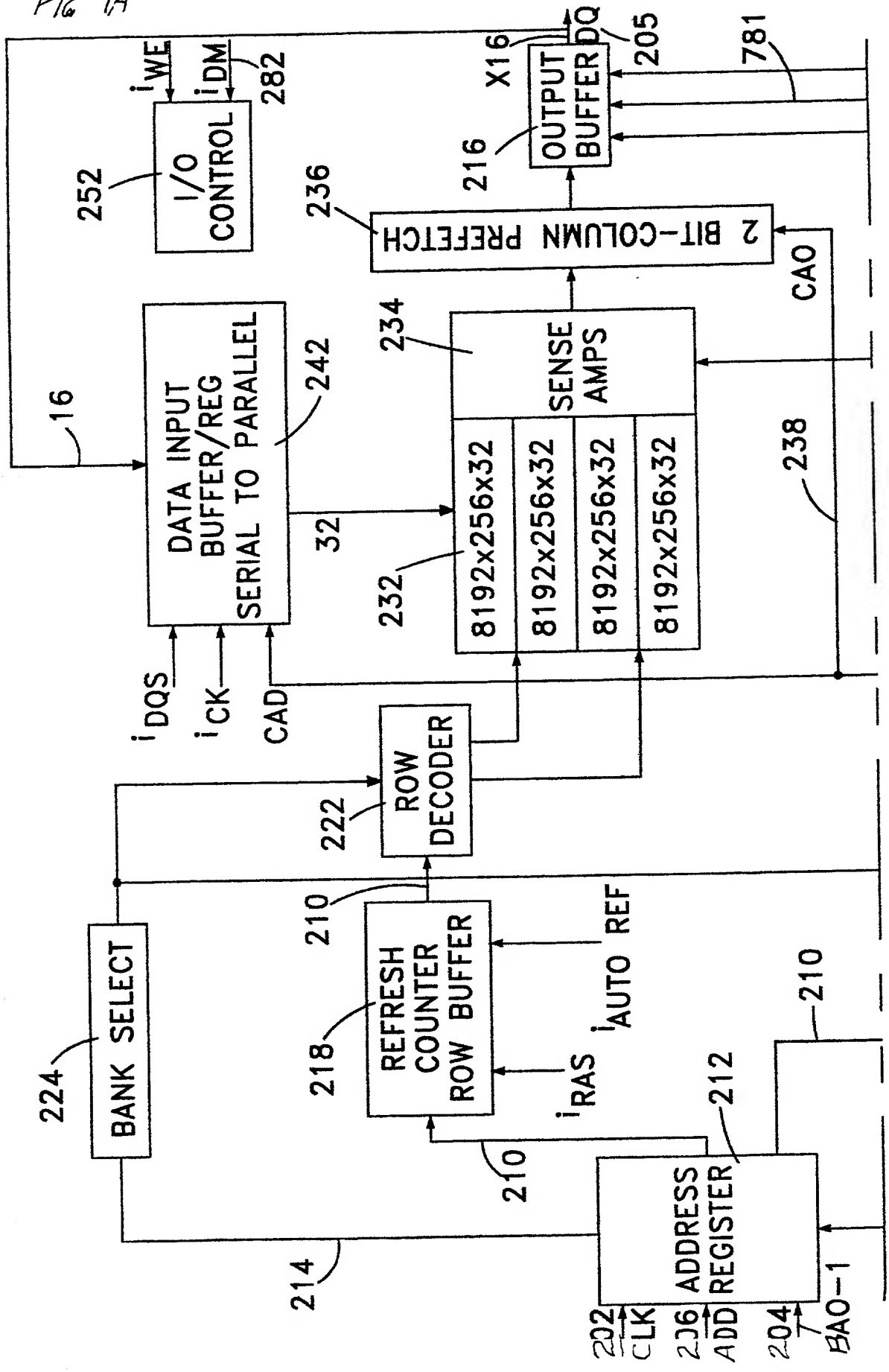
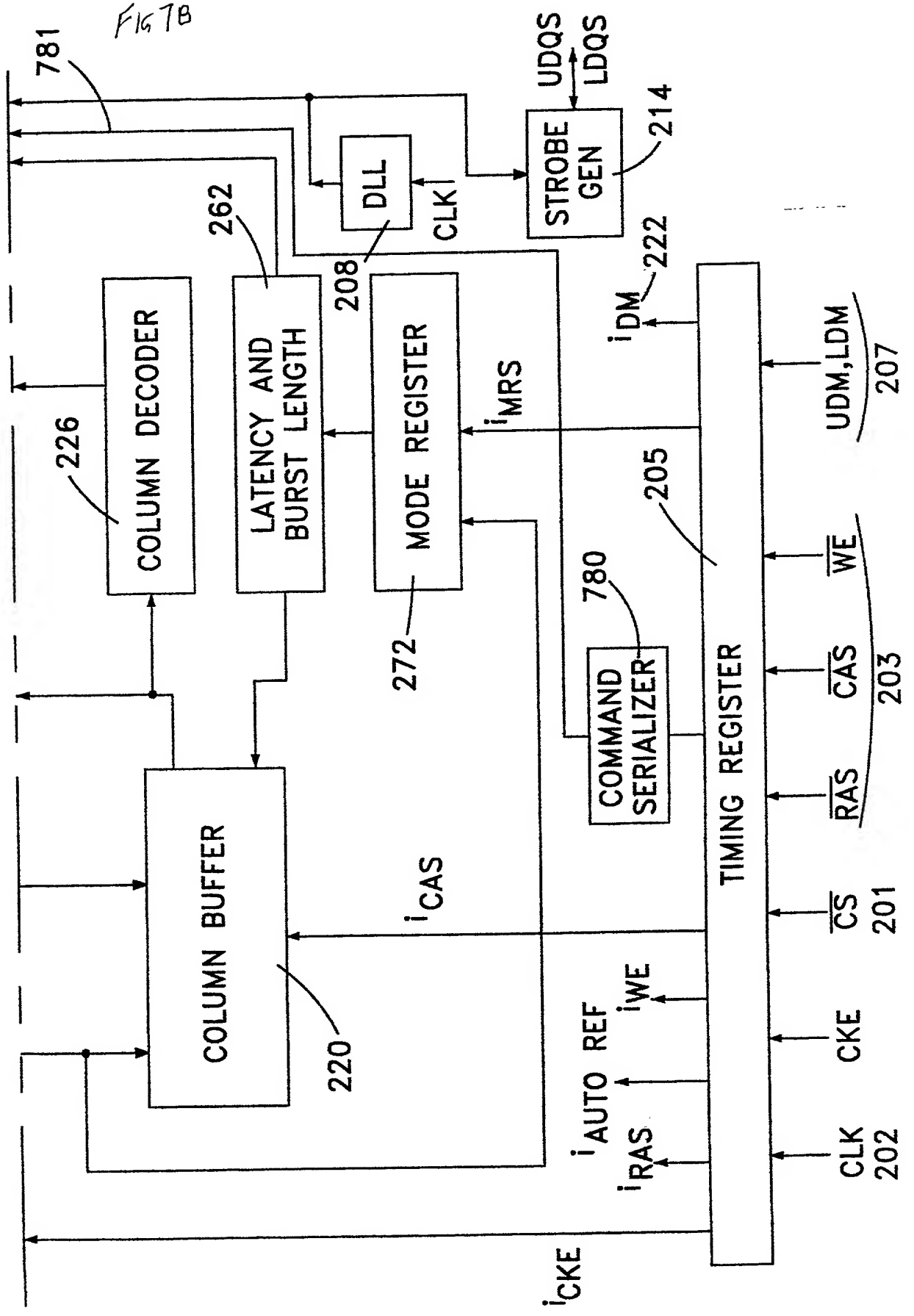

i WE
i DM
282
I/O CONTROL
252
X16
OUTPUT BUFFER
DQ
205
781
216
236
2 BIT-COLUMN PREFETCH
CAO
234
SENSE AMPS
16
DATA INPUT BUFFER/REG SERIAL TO PARALLEL
242
32
8192x256x32
8192x256x32
8192x256x32
8192x256x32
232
238
i DQS
i CK
CAD
ROW DECODER
222
210
REFRESH COUNTER ROW BUFFER
218
i AUTO REF
i RAS
BANK SELECT
224
212
ADDRESS REGISTER
214
202
CLK
206
ADD
204
BA0-1

FIG 7B


781
UDQS
LDQS
214
STROBE GEN
DLL
CLK
208
262
222
i_{DM}
UDM,LDM
207
COLUMN DECODER
226
LATENCY AND BURST LENGTH
MODE REGISTER
i_{MRS}
205
780
272
COMMAND SERIALIZER
TIMING REGISTER
WE
CAS
RAS
203
CS
201
CKE
CLK
202
COLUMN BUFFER
220
i_{CAS}
i_{WE}
$i_{AUTO\ REF}$
i_{RAS}
i_{CKE}

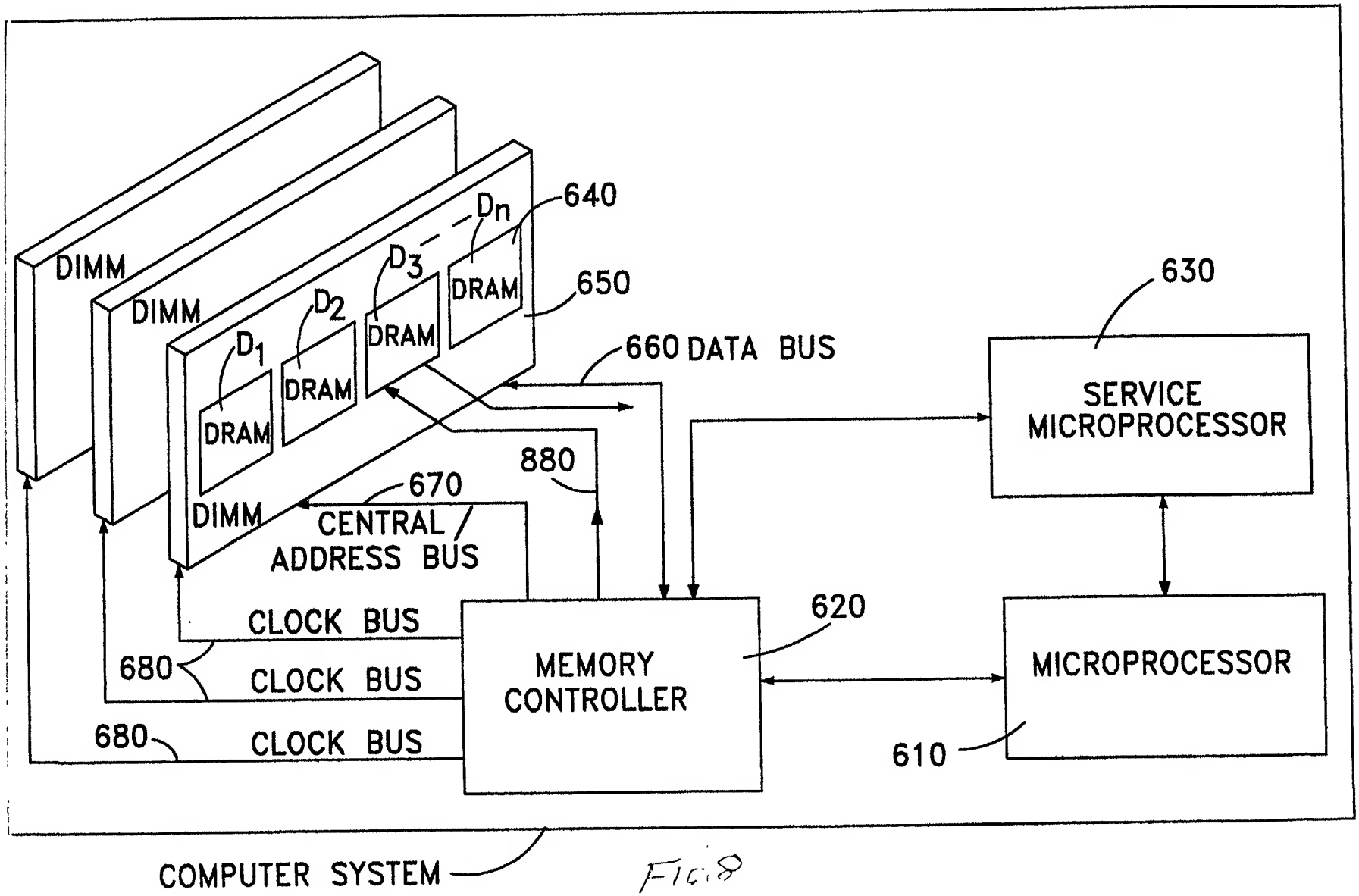
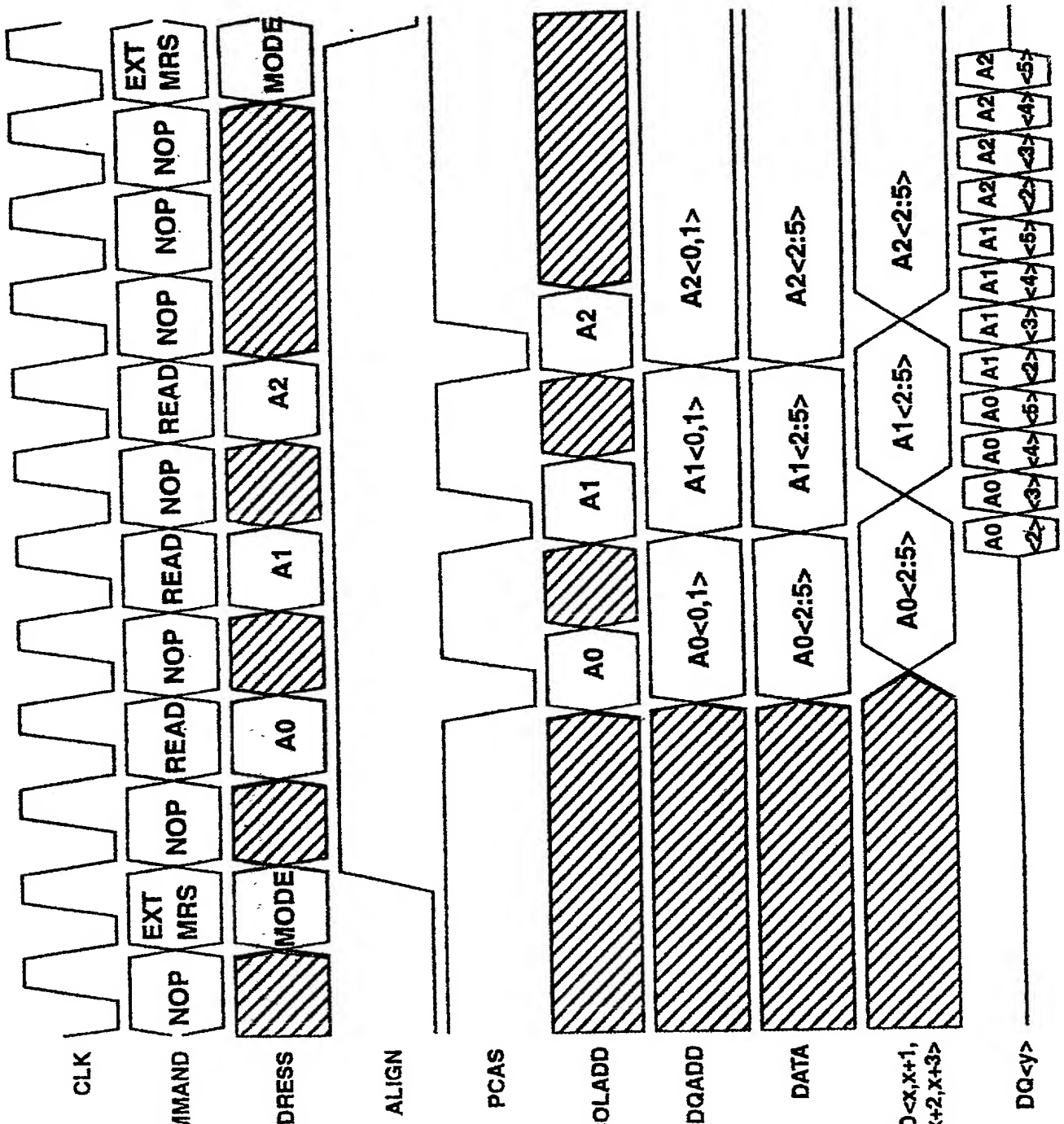

DIMM
DIMM
DIMM
DRAM
DRAM
DRAM
DRAM
D1
D2
D3
Dn
640
650
630
660 DATA BUS
SERVICE MICROPROCESSOR
880
670
CENTRAL ADDRESS BUS
CLOCK BUS
CLOCK BUS
CLOCK BUS
680
680
620
MEMORY CONTROLLER
MICROPROCESSOR
610
COMPUTER SYSTEM

Fig 8

FIG. 9


CLK
COMMAND
ADDRESS
ALIGN
PCAS
COLADD
DQADD
DATA
RWD<x,x+1, x+2,x+3>
DQ<y>
NOP
EXT MRS
NOP
READ
NOP
READ
NOP
NOP
NOP
NOP
MODE
MODE
A0
A1
A2
A0
A1
A2
A0<0,1>
A1<0,1>
A2<0,1>
A0<2:5>
A1<2:5>
A2<2:5>
A0<2:5>
A1<2:5>
A2<2:5>
A0 A0 A0 A0 A0 A1 A1 A1 A1 A1 A2 A2 A2 A2 A2
<2> <3> <4> <5> <2> <3> <4> <5> <2> <3> <4> <5>

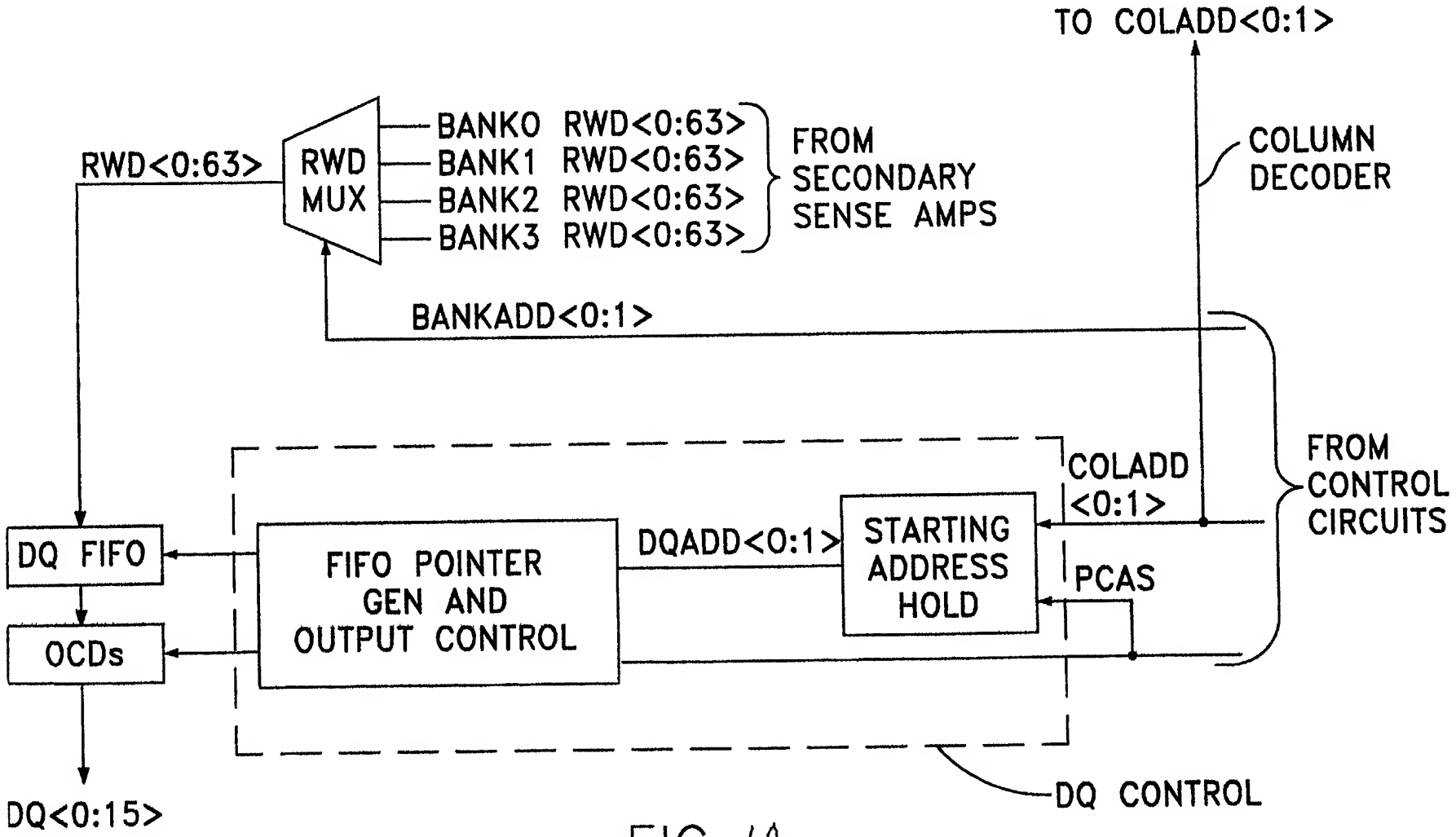


FIG. 10

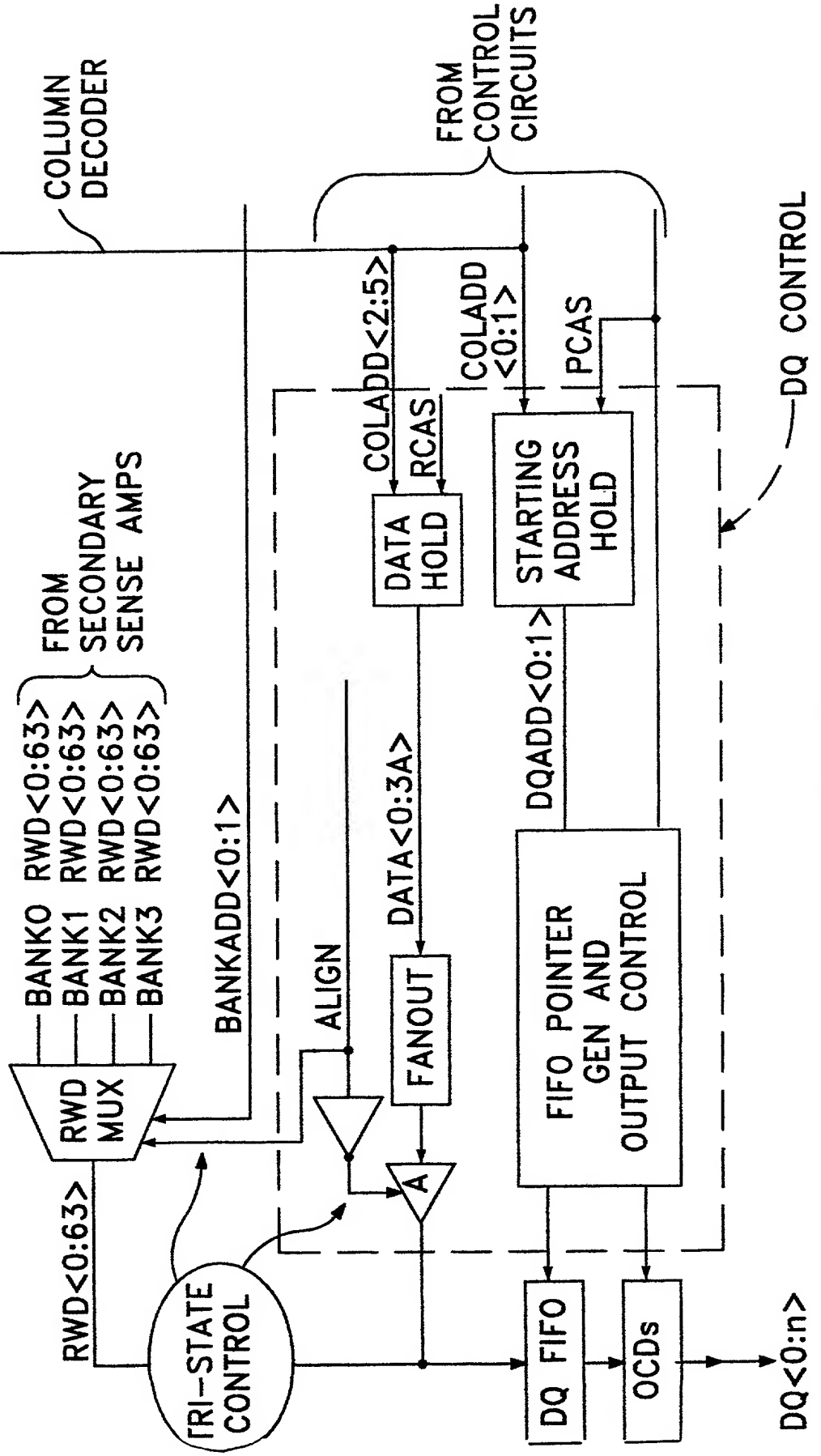
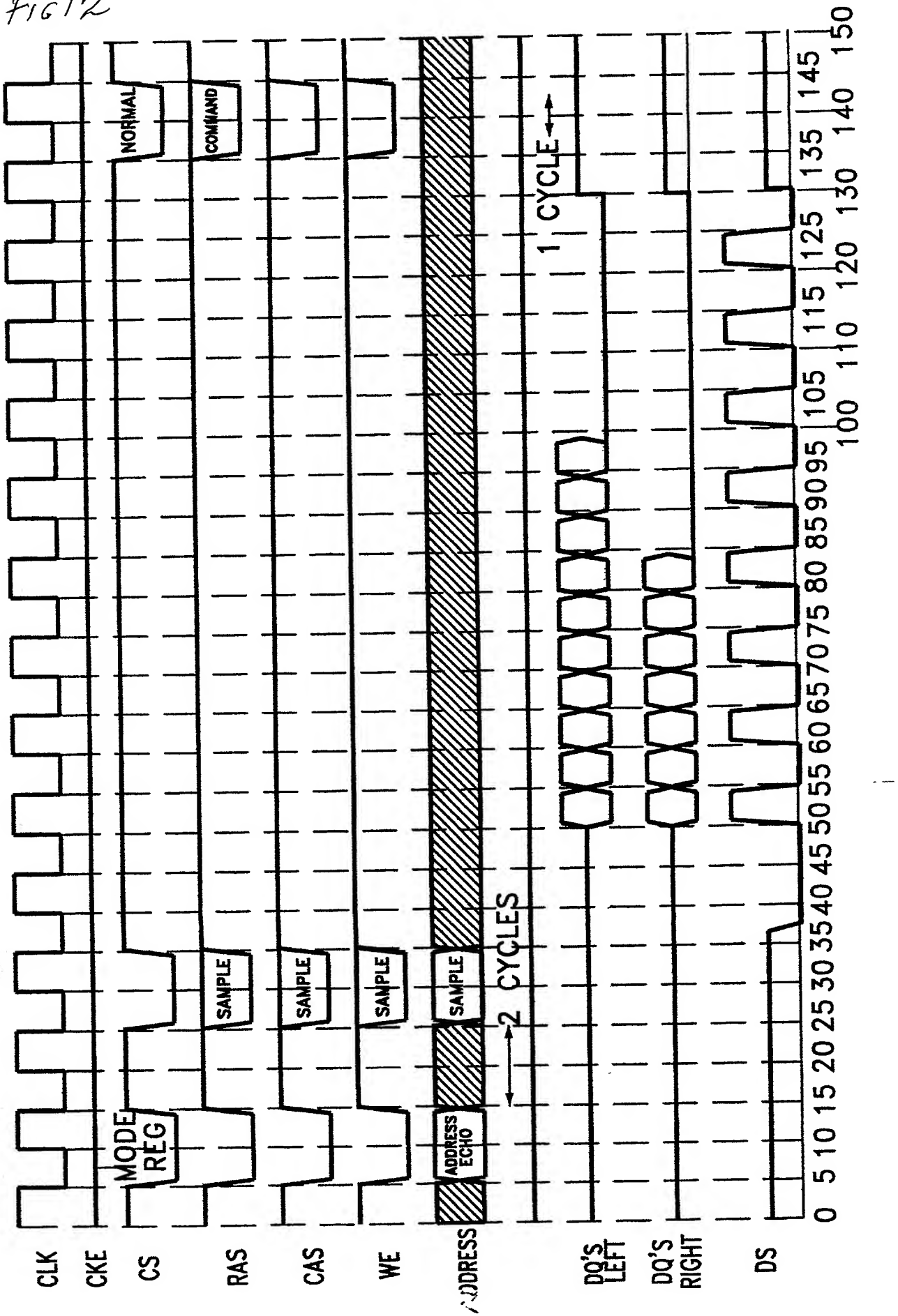


FIG. 11

FIG 12


CLK
CKE
CS
RAS
CAS
WE
ADDRESS
DQ'S LEFT
DQ'S RIGHT
DS
MODE REG
NORMAL
COMMAND
SAMPLE
ADDRESS ECHO
2 CYCLES
1 CYCLE
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 110 115 120 125 130 135 140 145 150